IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application	: **10/040,173**
Applicant(s)	: **VAIDYANATHAN et al.**
Filed	: **10/23/2001**
Confirmation	: **9007**
T.C./Art Unit	: **2611**
Examiner	: **KIM, Kevin**
Atty. Docket	: **US-010520**

Title: **METHOD TO IMPROVE ATSC-VSB TRANSCEIVER PERFORMANCE EMPLOYING A TIME-FREQUENCY WAVEFORM PROCESSOR**

Mail Stop: **APPEAL BRIEF - PATENTS**
Commissioner for Patents
Alexandria, VA 22313-1450

APPEAL UNDER 37 CFR 41.37

Sir:

This is an appeal from the decision of the Examiner dated 26 June 2007, finally rejecting claims 1, 3, 5, 8-9, 14-18, 22, 24, 27, 29-30, 35-39, 43-44, and 48-49 of the subject application.

This paper includes (each beginning on a separate sheet):

1. **Appeal Brief;**
2. **Claims Appendix;**
3. **Evidence Appendix; and**
4. **Related Proceedings Appendix.**

APPEAL BRIEF

I. REAL PARTY IN INTEREST

The above-identified application is assigned, in its entirety, to **Koninklijke Philips Electronics N. V.**

II. RELATED APPEALS AND INTERFERENCES

Appellant is not aware of any co-pending appeal or interference that will directly affect, or be directly affected by, or have any bearing on, the Board's decision in the pending appeal.

III. STATUS OF CLAIMS

Claims 2, 10-11, 23, 31-32, 45, and 47 are canceled.

Claims 1, 3-9, 12-22, 24-30, 33-44, 46, and 48-52 are pending in the application.

Claims 50-52 are allowed.

Claims 1, 3, 5, 8-9, 14-18, 22, 24, 27, 29-30, 35-39, 43-44, and 48-49 stand rejected by the Examiner under 35 U.S.C. 103(a).

These rejected claims are the subject of this appeal.

IV. STATUS OF AMENDMENTS

No amendments were filed subsequent to the final rejection in the Office Action dated 26 June 2007.

V. SUMMARY OF CLAIMED SUBJECT MATTER

This invention addresses channel equalization in wireless communications. In an example embodiment (applicants' FIG. 2), low-amplitude frequency-hopping sinusoidal waveforms (202) (page 11, lines 11-16) are added (203) to the baseband data signal (200) (page 10, lines 17-20), and this combined signal is modulated (201) and transmitted to a receiving system (page 10, lines 20-24). By including sinusoidal waveforms in the baseband signal, the transmission channel frequency response can be determined directly (page 3, lines 11-12), as contrast to conventional techniques that include applying a Fast Fourier Transform (FFT) to a training sequence at the baseband (page 2, lines 9-17). By using a low-amplitude frequency-hopping encoding of these sinusoidal waveforms, these sinusoidal waveforms merely appear as noise, thus providing compatibility with conventional (legacy) receivers (page 3, lines 11-16; page 9, line 18 – page 10, line 6).

As claimed in independent claim 1, an embodiment of the invention comprises a system (100, FIG. 1) for improving performance of wireless communications comprising:

a transmitter (101, FIG. 2) that is configured to produce (201) a modulated data signal that includes an addition (203) of one or more supplemental signals (202) on a plurality of frequencies to an input data signal (201) within a monocarrier channel employed to transmit the modulated data signal (page 10, lines 17-24), the one or more supplemental signals each employing a different frequency that changes during each of a plurality of periods to result in a time-varying frequency (page 11, lines 11-16), wherein the time-varying frequency for each supplemental signal changes from one period to a subsequent period in a predetermined sequence of frequencies within the channel (page 11, lines 4-7); and

a receiver (102, FIG. 3) that is configured to use the one or more supplemental signals to compute (305-306) a frequency domain channel estimate (page 12, line 23 – page 13, line 1) for use in equalizing (302) the channel during demodulation of the data signal (page 12, lines 7-13).

As claimed in independent claim 8, an embodiment of the invention comprises a transmitter (101, FIG. 2) for improved wireless communications comprising:

a symbol source (200) producing a data signal (page 10, lines 11-14);

a waveform generator (202) producing a time-varying signal that changes frequency during each of a plurality of periods (page 11, lines 11-18), wherein the frequency changes from one period to a subsequent period in a predetermined sequence of frequencies within a channel to be employed in transmitting the data (page 11, lines 4-7), the time-varying signal being transmitted with a power selected to avoid interference with demodulation of the data signal without reference to the time-varying signal (page 3, lines 12-16); and

a modulator (201) producing a transmission signal (204) from a sum (203) of the data signal and the time-varying signal (page 10, lines 17-24).

As claimed in independent claim 15, an embodiment of the invention comprises a receiver (102, FIG. 3) for improved wireless communications comprising:

an equalizer (302) performing channel equalization on a received signal utilizing a channel estimate (page 12, lines 7-10); and

a coherent demodulator (305) producing the channel estimate from the received signal and a time-varying signal corresponding to a portion of the received signal (page 12, line 23- page 13, line 1), wherein the time-varying signal changes frequency during each of a plurality of periods (page 13, lines 16-21), wherein the frequency of the time-varying signal changes from one period to a subsequent period in a predetermined sequence of frequencies within a channel on which the received signal is received (page 13, lines 11-14).

As claimed in independent claim 22, an embodiment of the invention comprises a method of wireless communication, comprising:

adding (203) one or more supplemental signals (202) on a plurality of frequencies to a data signal (200) within a monocarrier channel, the one or more supplemental signals each using a different frequency that changes during each of a plurality of periods to result in a time-varying frequency (page 11, lines 11-18), wherein the time-varying frequency for each supplemental signal changes from one period to a subsequent period in a predetermined sequence of frequencies within the channel (page 11, lines 4-7); and

computing (305) a frequency domain channel estimate for use in equalizing (302) the channel during demodulation of the data signal (page 12, lines 7-10) based on the one or more supplemental signals (page 12, line 23 – page 13, line 1).

As claimed in independent claim 29, an embodiment of the invention comprises a method for improved wireless communications, comprising:

producing (200) a data signal (page 10, lines 11-14);

producing (202) a time-varying signal that changes frequency during each of a plurality of periods (page 11, lines 11-18), wherein the frequency changes from one period to a subsequent period in a predetermined sequence of frequencies within a channel to be employed in transmitting the data (page 11, lines 4-7), the time-varying signal being provided with a power selected to avoid interference with demodulation of the data signal without reference to the time-varying signal (page 3, lines 12-16); and

producing (201) a transmission signal from a sum of the data signal and the time-varying signal (page 10, lines 17-24).

As claimed in independent claim 36, an embodiment of the invention comprises a method for improved wireless communications, comprising:

receiving (300) a received signal that includes a data signal and a concurrently transmitted equalization signal (page 8, lines 17-23);

generating (304) a time-varying signal corresponding to the concurrently transmitted equalization signal (page 11, lines 11-18);

producing (305) a channel estimate from the received signal and the time-varying signal (page 12, line 23 – page 13, line 1), wherein the time-varying signal changes frequency during each of a plurality of periods (page 13, lines 16-21), wherein the frequency changes from one period to a subsequent period in a predetermined sequence of frequencies within a channel on which the received signal is received (page 13, lines 11-14); and

demodulating (303) the data signal based on a channel equalization (302) of the received signal utilizing the channel estimate (page 12, lines 7-13).

As claimed in independent claim 43, an embodiment of the invention comprises a method for using a wireless communication signal, comprising:

providing (200) a data signal (page 10, lines 11-14); and

summing (203) at least one supplemental signal (202) with the data signal, the at least one supplemental signal having a frequency that changes during each of a plurality of periods in a predetermined sequence of frequencies (page 11, lines 11-18) for a channel in which the wireless communication signal is transmitted, the at least one supplemental signal having a power sufficiently less than a power for the data signal to permit demodulation of the data signal without reference to the at least one supplemental signal (page 3, lines 12-16).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

Claims 1, 3, 5, 8-9, 14-18, 22, 24, 27, 29-30, 35-39, 43-44, and 48-49 stand rejected under 35 U.S.C. 103(a) over Malkamaki (USP 6,337,855) and Tellado (USP 6,711,412).

VII. ARGUMENT

Claims 1, 3, 5, 8-9, 14-18, 22, 24, 27, 29-30, 35-39, 43-44, and 48-49 stand rejected under 35 U.S.C. 103(a) over Malkamaki and Tellado

MPEP 2142 states:

> "To establish a *prima facie* case of obviousness … the prior art reference (or references when combined) ***must teach or suggest all the claim limitations***… If the examiner does not produce a *prima facie* case, the applicant is under no obligation to submit evidence of nonobviousness."

Claims 1, 3 and 5

Claim 1, upon which claims 3 and 5 depend, recites a system that includes a transmitter that produces a modulated data signal that includes an addition of one or more supplemental signals on a plurality of frequencies to an input data signal.

The combination of Milkamaki and Tellado fails to teach or suggest adding supplemental signals on a plurality of frequencies to an input data signal.

The Office action relies upon Tellado for teaching that a supplemental signal on a plurality of frequencies is added to the input data signal, and asserts that Tellado provides this teaching at column 8, lines 42-53. The applicants respectfully disagree with this assertion.

Tellado teaches coordinating the transmission of signals from a plurality of transmitters (e.g. cell towers) so as to transmit the training sequence from each transmitter at a different carrier frequency. In this manner, a receiving system can determine the channel effects on each received training sequence; and, knowing the carrier frequency of the transmitter that is providing the desired signal and the carrier frequencies of the transmitters that are providing undesired signals, the receiver can

use these determined channel effects to enhance the desired signal and mitigate the undesired signals (Tellado, column 4, lines 10-20).

In an example embodiment, Tellado teaches providing a training pattern 28 to estimate the channel effects H_D on a desired (D) signal, and a training pattern 32 to estimate the channel effects H_{u1} of an undesired (u) signal, each of the training patterns 28 and 32 being transmitted at different carrier frequencies. At the text cited in the Office action, Tellado teaches:

> "Of course, the choice of carrier frequencies for training patterns 28, 32 can be changed at any time during operation to ensure good estimates of channel matrices H_D and H_{u1}. For example, a permanent assignment of training patterns to particular carrier frequencies may be disadvantageous if these frequencies are in a deep fade or if there is strong interference at these carrier frequencies. In this situation training patterns 28, 32 can be assigned to different carrier frequencies f_k, $f_{k+/-m}$ in accordance with a schedule or randomly. Such "frequency hopping" assignment of training patterns 28, 32 can be performed by a suitable centralized controller or a distributed coordinated controller." (Tellado, column 8, lines 42-53.)

Of particular note, Tellado teaches that the ***carrier*** frequency that is used to transmit the training patterns is changed in a frequency hopping manner. The applicants respectfully note that the frequency of a baseband signal is independent of the carrier frequency at which the signal is transmitted. Tellado's training patterns are baseband signals; Tellado's carrier frequencies are the frequencies that are used to modulate the training patterns.

In response to the applicants' argument that Tellado's training patterns are baseband signals, and not carriers, the Office action asserts that "Tellado clearly teaches that the training signals are carrier frequencies" (Office action, page 2, lines 8-9). This is incorrect; Tellado specifically teaches that the training signals are assigned to carrier frequencies, and clearly teaches that the training patterns comprise baseband symbols:

> "Desired signal X_D as viewed in the time domain has an initial training pattern 28 containing training symbols followed by symbols containing data or data portion 30. This structure is recursive, as each subsequent data portion 30 is preceded by initial training pattern 28." (Tellado, column 7, lines 4-8.)

As the above passage clearly indicates, Tellado teaches the conventional channel equalization technique of providing a sequence of predefined training symbols at the beginning of each block of data symbols. These training symbols are identical in structure to the data symbols, the only difference being that they form a known pattern for which differences at the receiver can be detected. The (baseband) frequency of this training pattern is dependent upon the symbols that form the sequence, just as the (baseband) frequency of each block of data symbols is dependent upon the symbols that form the sequence of data symbols. A sequence of constant symbols will have a lower frequency than a sequence of constantly changing symbols, regardless of the frequency used for transmitting these symbols.

The applicants further note that the claimed supplemental signals are added to the input data signal; as is well known in the art, the term carrier refers to a signal that is multiplied with the data signal to 'carry' the data at the carrier frequency. Adding a carrier signal to a data signal will not provide the carrier function defined in Tellado, and thus Tellado cannot be said to teach adding a carrier signal to an input data signal.

Further, assuming in argument that Tellado's frequency-hopping carrier signals can be considered to be equivalent to the claimed supplemental signals that are added to the input data signals, the applicants further note that claim 1 specifically recites that the supplemental signal employs a different frequency that changes during each period to result in a time-varying frequency, and that this time-varying frequency changes from one period to a subsequent period.

The Office action fails to identify where Tellado teaches that the carrier signals vary during each period and also change from one period to the next. Tellado teaches that each training pattern can be assigned to a different carrier frequency, but does not teach or imply that the carrier frequency is varied during the period that a carrier frequency is assigned to a training pattern. The principles of Tellado's invention rely upon the carrier frequency remaining constant during the transmission of each training pattern.

Because the combination of Milkamaki and Tellado fails to teach or suggest each of the elements of claim 1, the applicants respectfully maintain that the rejection of claims 1, 3, and 5 under 35 U.S.C. 103(a) over Milkamaki and Tellado is unfounded, and should be reversed by the Board.

Claims 8, 9, 14, 29-30, and 35

Claim 8, upon which claims 9 and 14 depend, recites a transmitter that includes a waveform generator producing a time-varying signal that changes frequency during each of a plurality of periods, and a modulator producing a transmission signal from a sum of the data signal and the time-varying signal.

Claim 29, upon which claims 30 and 35 depend, recites a method that includes producing a time-varying signal that changes frequency during each of a plurality of periods, and producing a transmission signal from a sum of the data signal and the time-varying signal.

The combination of Milkamaki and Tellado fails to teach or suggest producing a time-varying signal that changes frequency during each of a plurality of periods, and producing a transmission signal from a sum of the data signal and the time-varying signal.

The Office action fails to identify where either Malkamaki or Tellado teach producing a transmission signal from a sum of a data signal and a time-varying signal that changes frequency.

The Office action asserts that Tellado's carrier frequency corresponds to a time-varying signal that changes frequency from one period to another. Assuming, in argument, that this carrier frequency corresponds to the claimed time-varying signal that changes frequency, the applicants note that Tellado does not teach forming a ***sum*** of the data signal and this carrier frequency. As noted above, forming the sum of a data signal and a carrier signal will not perform the function defined by Tellado's carrier frequency, and thus Tellado cannot be said to teach forming the sum of a data signal and a carrier frequency, as asserted in the Office action.

Further, assuming in argument that Tellado's carrier frequency corresponds to the claimed time-varying signal that changes frequency from one period to another, the applicants respectfully note that Tellado does not teach that the carrier frequency also changes frequency during each period, as claimed in claim 8.

Further, assuming in argument that Tellado's carrier frequency can be said to correspond to the claimed time-varying signal, the principles of Tellado's invention clearly require reference to the carrier signal to demodulate the data signal, particularly if the carrier frequency is changed from one period to the next, as claimed in claims 8 and 29.

Because the combination of Milkamaki and Tellado fails to teach or suggest each of the elements of claims 8 and 29, the applicants respectfully maintain that the rejection of claims 8, 9, 14, 29, 30, and 35 under 35 U.S.C. 103(a) over Milkamaki and Tellado is unfounded, and should be reversed by the Board.

Claims 15-18 and 36-39

Claim 15, upon which claims 16-18 depend, recites a receiver that provides a channel estimate from a received signal and a time-varying signal that changes frequency from one period to a subsequent period.

Claim 36, upon which claims 37-39 depend, recites a method that includes providing a channel estimate from a received signal and a time-varying signal that changes frequency from one period to a subsequent period.

The combination of Malkamaki and Tellado fails to teach providing a channel estimate from a received signal and a time-varying signal that changes frequency from one period to a subsequent period.

The Office action relies upon Malkamaki for teaching a training sequence that provides a channel estimate, and asserts that Tellado teaches a training sequence comprising a time-varying signal that changes frequency from one period to a subsequent period. The applicants respectfully disagree with this assertion.

As noted above, Tellado teaches changing the carrier frequency used to transmit a training sequence. As also noted above, changing the carrier frequency used to transmit a training sequence does not change the frequency of the training sequence.

The applicants further note that the proposed combination of Malkamaki and Tellado will be ineffective for the intended purpose of the combination. Tellado teaches modifying the carrier frequency of the transmitted training signal. As is known in the art, and consistent with Tellado's teachings, the carrier is used in a transmitter to modulate a baseband signal to create an RF signal, and a local oscillator operating at the same carrier frequency at a receiver is used to de-modulate the RF signal to recreate the original baseband signal.

Changing the carrier frequency in Malkamaki's transmitter (6), and, corresponding in the local oscillator of Malkamaki's receiver (7), will have no effect on the operation of Malkamaki's design. Malkamaki's channel estimation (11) is performed at baseband, after the received signal is demodulated (7) (Malkamaki's FIGs. 2 and 3; column 3, lines 38-44).

Because the combination of Milkamaki and Tellado fails to teach or suggest each of the elements of claims 15 and 36, and because the combination of Milkamaki and Tellado will be ineffective for the intended purpose of the combination, the applicants respectfully maintain that the rejection of claims 15-18 and 36-39 under 35 U.S.C. 103(a) over Milkamaki and Tellado is unfounded, and should be reversed by the Board.

Claims 22, 24, and 26-27

Claim 22 recites a method that includes adding one or more supplemental signals on a plurality of frequencies to a data signal, the one or more supplemental signals each using a different frequency that changes from one period to a subsequent period.

The combination of Malkamaki and Tellado fails to teach adding one or more supplemental signals on a plurality of frequencies to a data signal, the one or more supplemental signals each using a different frequency that changes from one period to a subsequent period.

The Office action relies upon Tellado for teaching a supplemental signal on a plurality of frequencies that is added to the input data signal. As noted above, Tellado teaches changing the carrier frequency used to transmit a training sequence, and asserts that "Tellado clearly teaches that the training signals are carrier frequencies" (Office action, page 2, lines 8-9). This is incorrect. Tellado's training signals are baseband symbols, and not carrier frequencies.

Further, assuming in argument that Tellado's training signals are carrier frequencies, the applicants respectfully note that Tellado does not teach the addition of training signals at carrier frequencies to a data signal, as claimed in claim 22.

Because the combination of Milkamaki and Tellado fails to teach or suggest each of the elements of claim 22, the applicants respectfully maintain that the rejection of claims 22, 24, 26, and 27 under 35 U.S.C. 103(a) over Milkamaki and Tellado is unfounded, and should be reversed by the Board.

Claims 43-44 and 48-49

Claim 43 claims a method that includes summing a supplemental signal with a data signal, the supplemental signal having a frequency that changes during each of a plurality of periods.

The combination of Milkamaki and Tellado fails to teach or suggest summing a supplemental signal with a data signal, the supplemental signal having a frequency that changes during each of a plurality of periods.

The Office action fails to identify where either Malkamaki or Tellado teach producing a transmission signal from a sum of a data signal and a time-varying signal that changes frequency.

The Office action asserts that Tellado's carrier frequency corresponds to a time-varying signal that changes frequency during each of a plurality of periods. Assuming, in argument, that this carrier frequency corresponds to the claimed time-varying signal that changes frequency, the applicants note that Tellado does not teach forming a ***sum*** of the data signal and this carrier frequency. As noted above, forming the sum of a data signal and a carrier signal will not perform the function defined by Tellado's carrier frequency, and thus Tellado cannot be said to teach forming the sum of a data signal and a carrier frequency, as asserted in the Office action.

Further, assuming in argument that Tellado's carrier frequency can be said to correspond to the claimed time-varying signal, the principles of Tellado's invention clearly require reference to the carrier signal to demodulate the data signal, particularly if the carrier frequency is changed, as claimed in claim 43.

Because the combination of Milkamaki and Tellado fails to teach or suggest each of the elements of claim 43, the applicants respectfully maintain that the rejection of claims 43-44 and 48-49 under 35 U.S.C. 103(a) over Milkamaki and Tellado is unfounded, and should be reversed by the Board.

CONCLUSIONS

Because the combination of Milkamaki and Tellado fails to teach or suggest each of the elements of each of the applicants' independent claims 1, 8, 15, 22, 29, 36, and 43, the applicants respectfully requests that the Examiner's rejection of claims 1, 3, 5, 8-9, 14-18, 22, 24, 27, 29-30, 35-39, 43-44, and 48-49 under 35 U.S.C. 103(a) over Milkamaki and Tellado be reversed by the Board, and the claims be allowed to pass to issue.

Because the combination of Milkamaki and Tellado will be ineffective for the intended purpose of the combination, the applicants respectfully request that the Examiner's rejection of claims 15-18 and 36-39 under 35 U.S.C. 103(a) over Milkamaki and Tellado be reversed by the Board, and the claims be allowed to pass to issue.

Respectfully submitted

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CLAIMS APPENDIX

1. A system for improving performance of wireless communications comprising:

a transmitter that is configured to produce a modulated data signal that includes an addition of one or more supplemental signals on a plurality of frequencies to an input data signal within a monocarrier channel employed to transmit the modulated data signal, the one or more supplemental signals each employing a different frequency that changes during each of a plurality of periods to result in a time-varying frequency, wherein the time-varying frequency for each supplemental signal changes from one period to a subsequent period in a predetermined sequence of frequencies within the channel; and

a receiver that is configured to use the one or more supplemental signals to compute a frequency domain channel estimate for use in equalizing the channel during demodulation of the data signal.

2. (Canceled)

3. The system of claim 1, wherein

the predetermined sequence spans frequencies within the channel to directly provide a frequency domain channel estimate.

4. The system of claim 1, wherein

the predetermined sequence is coordinated with a field sync within the modulated data signal.

5. The system of claim 1, wherein

the one or more supplemental signals are each transmitted with a power selected to avoid interference with demodulation of the data signal without reference to the one or more supplemental signals.

6. The system of claim 1, wherein

the time varying frequency cycles through a plurality of frequencies within the predetermined sequence at a rate sufficient to permit multiple channel estimates for a single field of the modulated data signal.

7. The system of claim 1, wherein:

the predetermined sequence is coordinated with a field sync within the modulated data signal, and

the one or more supplemental signals are each transmitted with a power selected to avoid interference with demodulation of the data signal without reference to the one or more supplemental signals.

8. A transmitter for improved wireless communications comprising:

a symbol source producing a data signal;

a waveform generator producing a time-varying signal that changes frequency during each of a plurality of periods, wherein the frequency changes from one period to a subsequent period in a predetermined sequence of frequencies within a channel to be employed in transmitting the data, the time-varying signal being transmitted with a power selected to avoid interference with demodulation of the data signal without reference to the time-varying signal; and

a modulator producing a transmission signal from a sum of the data signal and the time-varying signal.

9. The transmitter of claim 8, wherein

the predetermined sequence spans the channel to directly provide a frequency domain channel estimate.

10. (Canceled)

11. (Canceled)

12. The transmitter of claim 8, wherein

the time varying signal cycles through each of the frequencies within the predetermined sequence at a rate sufficient to permit multiple channel estimates for a single field of the data signal.

13. The transmitter of claim 8, wherein:

the predetermined sequence is coordinated with a field sync within the data signal.

14. The transmitter of claim 8, wherein

the time-varying signal is one of a plurality of time-varying signals each having a different frequency during a period and each changing frequency from one period to a subsequent period in the predetermined sequence of frequencies.

15. A receiver for improved wireless communications comprising:

an equalizer performing channel equalization on a received signal utilizing a channel estimate; and

a coherent demodulator producing the channel estimate from the received signal and a time-varying signal corresponding to a portion of the received signal, wherein the time-varying signal changes frequency during each of a plurality of periods, wherein the frequency of the time-varying signal changes from one period to a subsequent period in a predetermined sequence of frequencies within a channel on which the received signal is received.

16. The receiver of claim 15, including

a waveform generator producing the time varying-signal,

wherein

a period duration and the predetermined sequence match a corresponding period duration and predetermined sequence employed in generating the received signal.

17. The receiver of claim 16, wherein:

the waveform generator produces a plurality of time-varying signals each having a different frequency during a period and each changing frequency from one period to a subsequent period in the predetermined sequence of frequencies, and

the coherent demodulator produces the channel estimate from the received signal and each of the time-varying signals.

18. The receiver of claim 15, wherein

the predetermined sequence spans frequencies within the channel to directly provide a frequency domain channel estimate.

19. The receiver of claim 15, wherein

the predetermined sequence is coordinated with a field sync within the received signal.

20. The receiver of claim 15, wherein

the time varying frequency cycles through each of the frequencies within the predetermined sequence at a rate sufficient to permit multiple channel estimates for a single field of the received signal.

21. The receiver of claim 15, including:

a channel estimate post-processor that is configured to:

smooth the channel estimate,

track time varying fades within the channel estimate, and

produce Doppler estimates for the channel estimate.

22. A method of wireless communication, comprising:

adding one or more supplemental signals on a plurality of frequencies to a data signal within a monocarrier channel, the one or more supplemental signals each using a different frequency that changes during each of a plurality of periods to result in a time-varying frequency, wherein the time-varying frequency for each supplemental signal changes from one period to a subsequent period in a predetermined sequence of frequencies within the channel; and

computing a frequency domain channel estimate for use in equalizing the channel during demodulation of the data signal based on the one or more supplemental signals.

23. (Canceled)

24. The method of claim 22, including

periodically changing a frequency for each supplemental signal in a predetermined sequence spanning frequencies within the channel, to directly provide a frequency domain channel estimate.

25. The method of claim 22, including

coordinating the predetermined sequence with a field sync within the data signal.

26. The method of claim 22, including

sweeping each supplemental signal through each of the frequencies within the predetermined sequence at a rate sufficient to permit multiple channel estimates for a single field of the data signal.

27. The method of claim 22, including

providing each of the supplemental signals with a power selected to avoid interference with demodulation of the data signal without reference to the one or more supplemental signals.

28. The method of claim 22, including:

periodically changing a frequency for each supplemental signal in a predetermined sequence of frequencies within the channel coordinated with a field sync within the data signal; and

providing each of the supplemental signals with a power selected to avoid interference with demodulation of the data signal without reference to the one or more supplemental signals.

29. A method for improved wireless communications, comprising:

producing a data signal;

producing a time-varying signal that changes frequency during each of a plurality of periods, wherein the frequency changes from one period to a subsequent period in a predetermined sequence of frequencies within a channel to be employed in transmitting the data, the time-varying signal being provided with a power selected to avoid interference with demodulation of the data signal without reference to the time-varying signal; and

producing a transmission signal from a sum of the data signal and the time-varying signal.

30. The method of claim 29, wherein

the predetermined sequence spans the channel to directly provide a frequency domain channel estimate.

31-32 (Canceled)

33. The method of claim 29, wherein

the time varying signal cycles through each of the frequencies within the predetermined sequence at a rate sufficient to permit multiple channel estimates for a single field of the data signal.

34. The method of claim 29, wherein:

the predetermined sequence is coordinated with a field sync within the data signal.

35. The method of claim 29, wherein

the time-varying signal is one of a plurality of time-varying signals each having a different frequency during a period and each changing frequency from one period to a subsequent period in the predetermined sequence of frequencies.

36. A method for improved wireless communications, comprising:

receiving a received signal that includes a data signal and a concurrently transmitted equalization signal;

generating a time-varying signal corresponding to the concurrently transmitted equalization signal;

producing a channel estimate from the received signal and the time-varying signal, wherein the time-varying signal changes frequency during each of a plurality of periods, wherein the frequency changes from one period to a subsequent period in a predetermined sequence of frequencies within a channel on which the received signal is received; and

demodulating the data signal based on a channel equalization of the received signal utilizing the channel estimate.

37. The method of claim 36, including

producing the time varying-signal with a period duration and the predetermined sequence matching a corresponding period duration and predetermined sequence employed in generating the received signal.

38. The method of claim 37, including

producing a plurality of time-varying signals each having a different frequency during a period and each changing frequency from one period to a subsequent period in the predetermined sequence of frequencies, wherein the channel estimate is produced from the received signal and each of the time-varying signals.

39. The method of claim 36, wherein the predetermined sequence spans frequencies within the channel to directly provide a frequency domain channel estimate.

40. The method of claim 36, wherein the predetermined sequence is coordinated with a field sync within the received signal.

41. The method of claim 36, wherein the time varying frequency cycles through all frequencies within the predetermined sequence at a rate sufficient to permit multiple channel estimates for a single field of the received signal.

42. The method of claim 36, including:

smoothing the channel estimate,

tracking time varying fades within the channel estimate, and

producing Doppler estimates for the channel estimate.

43. A method for using a wireless communication signal, comprising:

providing a data signal; and

summing at least one supplemental signal with the data signal, the at least one supplemental signal having a frequency that changes during each of a plurality of periods in a predetermined sequence of frequencies for a channel in which the wireless communication signal is transmitted, the at least one supplemental signal having a power sufficiently less than a power for the data signal to permit demodulation of the data signal without reference to the at least one supplemental signal.

44. The method of claim 43 wherein the predetermined sequence of frequencies spans the channel.

45. (Canceled)

46. The method of claim 43, wherein the at least one supplemental signal sweeps the predetermined sequence at a rate sufficient to permit multiple channel estimates based on the at least one supplemental signal within a single field of the data signal.

47. (Canceled)

48. The method of claim 43, wherein the at least one supplemental signal includes:

a plurality of supplemental signals each having a different frequency during a given period and each changing frequencies in the predetermined sequence from one period to a subsequent period.

49. The method of claim 43, wherein the wireless communications signal is a result of modulating the sum of the data signal and the at least one supplemental signal.

50. A transmitter for improved wireless communications comprising:

a symbol source producing a data signal;

a waveform generator producing a time-varying signal that changes frequency during each of a plurality of periods, wherein the frequency changes from one period to a subsequent period in a predetermined sequence of frequencies within a channel to be employed in transmitting the data, the predetermined sequence being coordinated with a field sync within the data signal; and

a modulator producing a transmission signal from a sum of the data signal and the time-varying signal.

51. A method for improved wireless communications, comprising:

producing a data signal;

producing a time-varying signal that changes frequency during each of a plurality of periods, wherein

the frequency changes from one period to a subsequent period in a predetermined sequence of frequencies within a channel to be employed in transmitting the data, the predetermined sequence being coordinated with a field sync within the data signal; and

producing a transmission signal from a sum of the data signal and the time-varying signal.

52. A method for using a wireless communication signal, comprising:

providing a data signal; and

summing at least one supplemental signal with the data signal, the at least one supplemental signal having a frequency that changes during each of a plurality of periods in a predetermined sequence of frequencies for a channel in which the wireless communication signal is transmitted, the predetermined sequence being coordinated with a field sync within the data signal.

EVIDENCE APPENDIX

No evidence has been submitted that is relied upon by the appellant in this appeal.

RELATED PROCEEDINGS APPENDIX

Appellant is not aware of any co-pending appeal or interference which will directly affect or be directly affected by or have any bearing on the Board's decision in the pending appeal.